Network Affiliation and Supplier Performance in the Japanese Automotive Industry

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ABSTRACT

This paper examines the performance of 126 Japanese auto parts suppliers and four automakers between 1980 and 1993. Contrary to the dual economy perspective, auto parts suppliers perform on average no worse than automakers. Contrary to resource dependence theory, suppliers that supply a large proportion of their output to a single customer do no worse than more independent suppliers. Instead, customers buffer their closest suppliers against exogenous shocks and redistribute profits between high and low-performing suppliers. Redistribution makes economic sense, as it encourages suppliers to make customer-specific investments. At the same time, it is embedded in the cultural context, social relations, and institutional environment of Japan.

INTRODUCTION

While research on interorganizational linkages has a long history (Oliver, 1990), interest in networks as an organizational form is relatively new. Over the past decade, scholars have increasingly treated networks as organizational forms distinct from markets and hierarchies (Powell, 1990). Implicit is the assumption that networks, at least in certain circumstances, perform better than markets or hierarchies. Networks, as collections of independent actors, respond more quickly and flexibly to changing economic conditions and patterns of demand than huge, integrated corporations (Piore and Sabel, 1984). Members of networks maximize learning by combining intense learning in long-term, dedicated relationships with diverse information gathered through a wide variety of weak ties (Uzzi, 1996). By relying upon social relationships to govern economic exchange, members of networks reduce transaction costs and reduce the need for costly governance structures (Williamson, 1985).

Although researchers have made a convincing case concerning the economic benefits of networks to regions and industries (Saxenian, 1994), they have had less to say about the distribution of economic returns among members of networks. While research has focused on networks of small firms of similar size and status, networks marked by asymmetries in firm size, status, and access to resources are perhaps less the exception than the rule (Harrison, 1994). Organization and economic theorists argue that asymmetries in bargaining power allow some firms to extract more returns than others (Burt, 1983; Pfeffer and Salancik, 1978; Porter, 1980), and network members that are larger, more centrally located, that possess resources or capabilities difficult to duplicate, or are able for other reasons to diversify their base of suppliers or customers will be more profitable.

Alternatively, networks may distribute returns according to a different logic—one that perpetuates the security and stability of the network as a whole and prevents any single member from extracting inordinate returns. There are a number of reasons that this behavior may exist. First, an individual firm may chose to sacrifice individual returns for the benefit of less fortunate network

members if it believes that the integrity of the network is critical to its own success. Second, if networks are social as well as economic entities, social norms for distribution of returns may take precedence over bargaining and exercise of power. Third, the logic of profit distribution may be entirely different depending upon the cultural and institutional environment in which a network is embedded. Perhaps the assumption that individuals use relative power to bargain for a greater piece of the pie is a uniquely American notion of how economies work, and that an entirely different logic of distribution exists in other contexts.

Nowhere is the issue of distribution of rewards among network members more pertinent and controversial than in networks of Japanese automakers and their suppliers. Sharp asymmetries in firm size, status, access to resources, and flow of transactions mark these networks. For many years, the dominant view among both Japanese and foreign scholars was that these networks were a means through which large buyers exploited their small suppliers (Clark, 1979; Watanabe, 1985). Japanese automakers, it was argued, contracted out a larger percentage of their parts to smaller, dependent suppliers and used their superior bargaining power to extract concessions—keeping suppliers alive, but not particularly profitable.

Recently, this view of powerful automakers and dependent suppliers has come into question. Detailed examinations of Japanese purchasing practices have found considerable cooperation between automakers and their suppliers—more than might be expected if these relationships were exploitative (Nishiguchi, 1994; Smitka, 1991). There have been several analyses of supplier performance given these new assumptions of cooperative relationships. Kawasaki and McMillan (1987), for example, posit a complex risk-sharing arrangement between buyer and supplier, while Ries (1993) asserts that certain suppliers bargain for a larger share of the returns to the network, gaining bargaining power through superior technology and skills. These analyses, however, are based upon assumptions that are in many ways quite similar to the older view of buyer-supplier relations. Although in the newer analyses buyers and suppliers drive more sophisticated bargains involving risk-sharing, and the determinants of power are technology and knowledge rather than

sheer size and economic power, the assumptions that firms are individual actors, maximizing their own self interest, and bargaining for the most individually beneficial deal, persist.

Can we assume individual, self-interest maximizing behavior on the part of these firms? Economic organization is embedded—in social, political, and economic institutions, which vary widely across countries The assumption of firm as individual actor is highly influenced by particularities of American economic development—in particular, assumptions about the balance between the role of the state and private institutions (Hamilton and Biggart, 1988). Japan is an economy of groups—dominated by horizontal groups of large firms in diverse markets, groups of core manufacturers and their suppliers and distributors, and many other groups of affiliated firms. There is a growing evidence that these groups are collective actors—and not merely sets of individual firms linked through contracts (Lincoln, Gerlach, and Ahmadjian, 1996). If this is the case, we cannot understand the behavior of these groups in terms of self-interest of individual firms—and a bargaining perspective, no matter how sophisticated, does not explain how returns are allocated within these groups.

This paper presents an examination of the relationship between network affiliation and performance among 126 Japanese auto parts suppliers between 1980 and 1993. In this paper, I compare two perspectives regarding supplier performance. The first, based upon a bargaining logic of distribution, is that returns are distributed through bargaining power, and customers, and their more powerful suppliers extract a greater portion of returns to the network. According to the second perspective, economic returns are distributed through a network logic of distribution. Customers sacrifice excess returns to maintain the economic health of their suppliers, and strong suppliers give up profits to support weaker ones. This behavior may be economically sound—since the maintenance of relationships is important to the smooth functioning of the network. But this behavior is also deeply rooted in Japanese, social, cultural, economic, and political institutions.

The first section of the paper contrasts the bargaining and network logics of distribution. The next section examines these two perspectives in a statistical analysis of group membership and profitability. In the discussion section, I discuss some of the implications of a network logic of distribution, and explore the economic benefits of such a system, drawing upon interviews with managers at Japanese automakers and parts suppliers.

A BARGAINING PERSPECTIVE ON DISTRIBUTION

For many years, the notion that supply networks were a source of constraint, a means of extracting excess rents from powerless suppliers, dominated the outlook on supply relations among Japanese scholars (Watanabe, 1985). According to this line of reasoning, rapid growth combined with a heavy concentration of banking and industry in the hands of the great zaibatsu conglomerates, combined with state and zaibatsu control of the banking system, the high cost of imported technology, and rapid population growth, resulted in the division of the Japanese economy into a core of large, modern firms and a periphery of small, backward firms (Broadbridge, 1966). Large firms took advantage of their size and superior bargaining power to extract rents from suppliers.

Although this stream of literature, referred to in Japanese as the *nijyu-kozo*, or dual economy, has theoretical roots in Marxist economics, this notion of large manufacturers using their superior power to extract concessions from small, dependent suppliers, can also be interpreted in terms of resource dependence theory. According to resource dependence theory, an organization's relative power resides in its position in the exchange of resources (Emerson, 1962; Pfeffer and Salancik, 1978). The degree to which an organization has power depends upon its possession of resources that are critical, have few substitutes, and are in high demand. The greater bargaining power of firms that have more power relative to their customers and suppliers will be translated into higher profits (Burt, 1983).

The dual economy perspective suggests that there are structural factors leading to superior customer power. Japanese economic policies, which favored large firms over small, meant that

financing was channeled to larger firms, which were then able to quickly develop through purchase of foreign technology. Japanese banks have historically tended to be risk averse, and poor flow of information in the years of Japan's development caused Japanese banks to prefer to lend to larger firms. These factors left suppliers with little choice but to rely upon their customers for financing, and technical expertise.

While liberalization of financial markets has given smaller firms more options, and supplier technology levels have developed substantially, auto parts suppliers remain much smaller than automakers. For example, Toyota in the mid-1980's had about four times the assets of its largest supplier, Nippondenso. If size differentials reflect differentials in access to resources, and suppliers, dependent upon their customers for technology, financing and skilled personnel, are unable to resist an automaker's demands for lower prices, this is likely to show up in profit differentials.

H1: Auto parts suppliers are less profitable than automakers.

According to the dual economy perspective, large manufacturers not only extract rents from their suppliers, but use their suppliers as buffers through a process described as "*shiwayose*," or wrinkle-smoothing. This ability to smooth wrinkles in performance due to exogenous shocks or firm-specific problems is particularly important for large Japanese firms, with their implicit contract of "life-time" employment to regular male employees. Large firms, it is argued, maintain stable levels of employment by bringing parts production in-house during lean times and sending it out to suppliers in times of excess demand. Even if they do not actually change the location of parts production, they can stabilize their profit margins by striking a harder bargain on prices with their suppliers during times of poor performance or by extending payables (Clark, 1979; Van Wolferen, 1989). It has been claimed that this buffering by suppliers allowed Japanese automakers to respond quickly to the yen shock of 1985 (referred to as the *endaka*, or high yen, shock), when the value of

the yen nearly doubled as a result of the Plaza Accord, suddenly putting Japan's booming export businesses at a cost disadvantage (Sakai, 1990).

H2: The profits of auto parts suppliers are more variable than the profits of automakers.

In the dual economy tradition of research on buyer-supplier relations in Japan, there has been little attempt to differentiate between types of suppliers. Scholars have tended to treat suppliers and buyers as separate classes, and draw contrasts between these two competing classes. Taking the resource dependence framework one step further, however, we can also predict that there will be differences in performance among suppliers themselves, depending upon the relative power of the suppliers.

Auto parts suppliers in Japan, even relatively small number of first tier suppliers that sell directly to the automakers, are a diverse group of organizations by most measures of power and dependence. First tier suppliers vary in size: when measured by number of employees, from almost 40,000 to under 100. The range of dependence on a single automaker 100 percent to minimal. Products manufactured by the first tier range from highly advanced electronically controlled assemblies such as electronic fuel injection systems to more simple parts such as lights and springs.

Several measures of dependence are particularly relevant to Japanese auto parts supply networks. First is a supplier's dependence upon a single buyer for purchase of a large percentage of its production volume. Burt (1983), in his research linking dependence to firm performance, used industry concentration of buyers and suppliers as a measure of dependence, but there is reason to believe that it is the dyad—the degree to which a given supplier is dependent upon a given customer—that is relevant in the Japanese case. Japanese auto parts suppliers do not switch customers very often, and beginning a new relationship, when possible, is a slow and time-consuming process.

H3: The greater the concentration of a supplier's sales to one automaker, the less profitable that supplier will be.

Firm size should also make a difference—not only in the relative power between automaker and supplier, but among suppliers themselves. Larger suppliers are not only more likely to have superior access to financial and human resources, but have deep enough pockets to risk short-term loss and negotiate aggressively with their customers. Observers of Japanese supplier networks have also argued that larger suppliers have developed greater levels of knowledge and skill, especially customer-specific knowledge. This makes these larger suppliers more difficult to replace for automakers, and in turn, gives them more bargaining power vis a vis the automakers (Ries, 1993).

H4: The smaller a supplier is, the less profitable it will be.

A NETWORK LOGIC OF DISTRIBUTION

The bargaining perspective assumes that firms are individual actors concerned with maximizing their own profitability. Scholars, however, have pointed out that the notion of the firm and its interests, is embedded in the cultural and institutional environments (Hamilton and Biggart, 1988; Granovetter, 1985). Depending upon the context, a firm may define its interests over a wider group of firms, and its interests may be defined in terms other than profit maximization. The alternative—that firms construct their economic identities in groups, networks, or families—and we must observe behavior as group members.

There is reason to believe that this is the case in Japan. Japan is an economy of groups. These groups range from horizontal keiretsu, of large firms in different markets, revolving around similar main banks and trading firms, to groups of suppliers and their customers, to manufacturers and distributors. Not all firms in Japan are group members—and strength of group affiliation varies widely, but those that are appear to have a distinct group identity. Students of Japanese industrial

groups have pointed out the strong communitarian tendency of these groups. As Orru, Hamilton, and Biggart (1991: 387) write:

> "Japanese enterprise groups enact a communitarian ideal. Like residential, intellectual, and other forms of community, Japanese business groups maintain clearly defined status relations among firms, some of which are egalitarian and others hierarchical. While there are clearly more important and more influential firms within enterprise groups, the decision-making unit is the group, and command is exercised not by fiat but by consensus. Decisions are made considering what is best for the collectivity, not simply for individual firms, however powerful."

The notion of the industrial group in Japan as a community rather than individual firms bargaining for their own best interests suggests a radically different means of allocation of returns among networks. It suggests a community, or a network logic of distribution of returns, in which the strong sacrifice for the weak, and the goal is to keep all group members healthy.

The network logic of distribution has, indeed, been found in analyses of horizontal groups of large Japanese firms. In an analysis of the relationship between group membership and performance among 200 of Japan's largest firms, Lincoln, Gerlach, and Ahmadjian (1996) found that among members of intermarket groups, profits were diverted from higher to lower performers. They assert: "There is a collective logic to the keiretsu phenomenon that, in our view, is not reducible to rational optimizing on the part of individual firms (p. 86)." Corporate self-interest seeking, they argue, is constrained in Japan by social commitments and normative rules.

Lincoln et al (1996) examine the network logic of distribution only in horizontal networks of large firms—in particular, the famous "big six" groups of Mitsui, Mitsubishi, Sumitomo, Fuyo, Sanwa, and Dai-ichi Kangyo. These groups are certainly important—but by no means represent the entire Japanese economy. The authors barely mention the vertical keiretsu—of large manufacturers and

their suppliers, suggesting, only in passing that in these vertical groups are distinctly different than the Big Six.

But are vertical groups of core manufacturers and suppliers so different? Orru et al (1991: 386) argue that there are high levels of isomorphism in the characteristics of business groups in the same economy. Shared political, social, and economic context generate "a characteristic pattern of business relationships. These relationships are not simply ones of convenience or efficiency, but represent enactments of socially acceptable, institutionalized forms of economic behavior—they are the manifestations of a normative structure that underlies economic activity and provides market order." If members of the big six groups redistribute economic returns from the strong to the weak, and this is based upon a notion shared across the Japanese economy, and supported by the same social, political, and economic institutions, that business groups are collective actors, working for the interests of the group as a whole, we are likely to the same network logic of distribution in other types of Japanese corporate groupings as well.

This fundamentally different conception of the firm as a collective actor, reinforced by cultural, institutional, and transactional pressures, suggests that the assumption that economic returns are distributed among firms through a bargaining logic is mistaken. Given this nature of the firm, we should expect rather, that returns are distributed through a logic which emphasizes survival and stability of the network as a whole, and preservation of intangible investments, in knowledge, skills, and relationships, that have been made by network members.

A network logic of distribution within parts supply networks suggests two different processes. First, we should observe automakers assisting suppliers—buffering suppliers from the adverse effect exogenous shocks and from the adverse effect of the automaker's own poor performance. This is the opposite of the dual economy hypotheses that predict that it is the suppliers that buffer automakers from adverse economic conditions. In this case, profits are being redistributed between automaker and supplier.

Second, we should observe redistribution occurring between suppliers themselves. Customers may intervene in the performance of individual suppliers—either making constant adjustments to maintain a steady level of profitability, or intervening when a supplier reaches a critically high or low level. The existence of such a redistribution effect among suppliers will be discernible in the relationship between a supplier's past and present performance. If lower performing suppliers are being bailed out by other group members and their customers, they will recover more quickly from periods of poor performance than independent suppliers that have met with financial troubles. Conversely, high-performing suppliers that are closely affiliated to supply networks will show a deterioration in performance more quickly than independent suppliers, as some of their excess returns go to other members of the group.

It would be difficult to test such a proposition if all suppliers were closely affiliated to supplier networks—through regression to the mean alone we should expect both high and lower performers to trend toward average levels of profitability over time. However, not all auto parts suppliers are closely affiliated to automaker groups. There is quite a bit of diversity among auto parts suppliers, in the percentage of their output that they sell to specific automakers, as well as in the degree to which automakers hold equity stakes in them—one of the most public signs of commitment and affiliation in the Japanese economy (Ahmadjian, 1997). We should observe this redistribution effect in the suppliers which are most closely affiliated to automakers on one or both of these dimensions.

H5: The effect of close affiliation with an automaker on a supplier's profits depends upon that supplier's prior profits. Among poor performers, the profits of suppliers tied to an automaker through equity or high dependence for sales will improve to a greater extent over the next period than those of non-affiliated suppliers. For excellent performers, the effect will be the opposite: the profits of suppliers tied to an automaker will decrease to a greater extent over the next period than those of non-affiliated suppliers.

Figure 1 documents this effect. The line labeled "affiliated" indicates the relationship between ROA in the previous period and ROA in the present period for suppliers closely affiliated to automakers. The line labeled "independent" indicates the relationship between ROA in the previous and present period for independent suppliers. Note that the slope of the affiliated line is less than the slope of the independent line—the relationship between profits in the previous period and profits in the present period is lower for closely affiliated suppliers than independents. Imagine, for example, a supplier whose profits dip to an extremely low level—say an ROA of -.05. If this supplier is closely affiliated with an automaker, the automaker and other suppliers will intervene quickly—and that supplier may achieve an ROA of -.025 in the next period. An independent supplier will also improve somewhat—but with less help from the group, the improvement will be less rapid—perhaps it will improve to -.04 in the next period.

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Figure 1 about here

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The story is the opposite for high performers. Imagine a supplier that has done particularly well and achieved an ROA of .1. If it is closely affiliated to an automaker, the automaker is likely to drive a harder bargain in the next period, or to encourage the supplier to assist more troubled members of the group—through sharing of technological or managerial expertise, or even capital. In the next period, we might expect its ROA to decrease to .05. An independent supplier, on the other hand, does not need to worry about a group. In the next period, its profits may decrease—but will still remain at very high levels—say .08.

Profits can be diverted from higher to lower performing suppliers in a number of ways. An automaker might make more generous, or more rigorous demands for price reductions in the semi-annual price-renegotiation process (it is through this regular renegotiation process rather than

through formal contracts that prices are determined). Manipulation of purchase price is not the only option. An automaker can use trade credit, through the adjustment of payables and receivables, to provide suppliers with assistance (Hodder and Tschoegl, 1985). An automaker, or other suppliers, may dispatch skilled management to a troubled supplier. A high-performing supplier may, conversely, be expected to take on excess employees of a poor performing supplier. A high performing supplier may be asked to share its proprietary technical knowledge with more backward suppliers.

DATA AND METHODS

Sample

The sample consists of 126 suppliers of 11 major Japanese auto assemblers between 1980-1993. These suppliers represent most publicly traded suppliers listed in *Jidosha Buhin no 160 Hinmei no Seisan Ryutsu Chosa* (*A survey of manufacture and distribution of 160 auto parts*) published in 1987 by IRC, a private purveyor of business information. This report lists purchase transactions for 160 auto parts. It includes for each part the volume sold by each supplier to each of the 11 Japanese auto manufacturers. Data on automakers' equity stakes in suppliers come from the 1989 volume (containing data for 1987) of *Kaisha Nenkan*, annual corporate reports for firms listed on Japanese stock exchanges (Nikkei, 1989). This volume is published annually by the Nihon Keizai Shimbun-sha, a leading publisher Japanese economic data. Since shareholding and transaction data were available only in hard copy form and must be translated and coded through a time-consuming process, only one year of data was collected, and thus, these measures do not vary over the period. However, there is reason to believe that the identities of shareholders and transaction volumes were quite stable up until the early 1990's: Gerlach (1991), for example, finds very low levels of change in cross-shareholding, in particular in the top 10 largest shareholders, during this period.

Annual performance and other financial data for the 14 years from 1980 and 1993 were obtained from the Nikkei NEEDS tape, an electronic version of the annual corporate reports. Because

performance data for only listed suppliers were available on tape, only listed suppliers (a total of 126 firms) are included in the analyses.

Not all first-tier suppliers are listed on the Tokyo stock exchange, and thus this sample does not represent the complete universe of suppliers. The IRC report includes a total of 131 first tier suppliers—the data set analyzed in this paper represents only the listed suppliers (performance data for 5 listed suppliers were not available). The results in this paper, therefore, represent only the listed firms, and clearly, more research must be done on unlisted firms. There are several obstacles, however, to obtaining profitability measures for unlisted firms. While there are reports of unlisted firms, such as *Nikkei Kaisha Sokan*, these reports tend to have many missing years—financial reports for the same firms are not reported every year, which makes longitudinal analysis difficult. Other, publications include more firms for more years, but are limited in the extent of financial and shareholded data reported.

The primary difference between listed and unlisted firms is size (although family ownership is another one). We can begin to make inferences on differences between listed and unlisted firms through examining the effect of size as an independent variable—and comparing smaller and larger listed firms.

Dependent variable

The dependent variable is firm performance. Firm performance, in Japan or elsewhere, is notoriously difficult to measure. We are faced not only with the question of the proper measures of performance, but with measurement error: taxes, variation in financial reporting standards and creative accounting can all affect how results are reported. The analyses presented in this paper measure performance as *keijyo rieki,* profits from operations and other activities, before taxes, dividends and extraordinary items, divided by total assets. This measure of performance captures the effect of adjustments to supplier performance through both manipulation of purchase prices and

prices of inputs as well as such factors as preferential rates for bank loans, and managerial expertise.

ROA has been the variable of interest in much previous research on group affiliation and firm performance in Japan (see Caves and Uekusa, 1976; Nakatani, 1984; Lincoln, Gerlach and Ahmadjian, 1996). By using this measure, direct comparisons to previous studies can be drawn. I also examined ROA based upon different measures of profitability (operating profits and after tax profits), as well as return on equity and return on sales. Although I do not report these analyses in this paper, I do discuss how these dependent variable compare with the *keijyo rieki* based ROA in the Findings section.

Independent variables

Buyer shareholding: One measure of how close a supplier is to an automaker is the percentage of its shares held by automakers. For each supplier, the percent of its shares held by each automaker was calculated. In most cases, only one automaker hold a supplier's shares, although there were several cases in which multiple automakers are shareholders. Automaker is equivalent to buyer in all cases, since there are no cases in which an automaker holds shares of a supplier with which it has no business. The measure of automaker shareholding is based upon a supplier's top 10 shareholders, since the Nikkei volumes from which the data were obtained only reports the top 10 shareholders. Shareholding is also measured separately for each automaker (e.g. percentage of shares held by Toyota).

Volume dependence: There are two measures of volume dependence: one across all suppliers, and the other for each specific automaker. The first measure of dependence is a Herfindahl measure constructed by adding the square of a supplier's dependence on each of its customers (e.g. the percentage of its total output sold to Toyota squared, plus percentage of its total output sold to Nissan squared, and so on). A value of 1 indicates that a supplier is entirely dependent upon a single customer while a lower value indicates that the supplier splits its output among many

customers. Dependence is measured as the percentage of total output sold to the customer in question (e.g. the percentage of total output sold to Toyota).

Other independent variables: Supplier size is measured by total assets. Since *keijyo rieki*, the measure of profits used, is calculated after interest payments and is thus affected by degree of leverage, the ratio of debt to equity is included as a control. Year of a supplier's founding and fiscal year are also added as controls.

Model and estimation procedures

Because OLS gives inefficient estimates of slopes and biased estimates of standard errors with panel data, the Fuller-Battese procedure in the SAS TSCSREG routine was used. The Fuller-Battese (variance component) model decomposes the random errors:

$$Uit=Vi + et + \varepsilon it \quad i=1,2,...,N;\ t=1,2,...,T$$

where the Vi is the error component associated with firm i, et is the error component associated with period t and εit is the error component unique to firm i in period t. A fixed effects model in which dummy variables are used to control for firm and time differences is not appropriate here since several independent variables—including the two measures of network affiliation, automaker equity position and purchasing dependence on automaker—do not vary over time. [1]

[1] Analyses were also conducted using the Parks routine, also avialable in SAS TSCSREG. The Parks method assumes first-order autoregression and contemporaneous correlation between cross section. The Parks routine estimates of coefficients for the variables of interest are quite similar to those produced by Fuller-Batteste, and in several cases, the Parks routine produced higher significance levels.

The model addresses levels of performance as well as the redistribution effect predicted by Hypothesis 5, in which core firms and other group members intervene when a supplier's performance is above or below a reasonable level. If a supplier's profitability in a given period is below a certain level, the core firm, and perhaps other suppliers, intervene to help it regain profitability by the next period. If a supplier's profitability in a given period is much higher than that of the rest of the group, again group members will intervene—demanding lower prices or assistance to poorer performers—and the profitability will appear closer to average levels for the group in the next period. The model of this process is based upon a model developed by Lincoln, Gerlach, and Ahmadjian (1996) to examine the redistribution effect in intermarket networks of large Japanese firms.

$$ROA_{it} = \alpha + \beta' x_{it} + \lambda G_i + \gamma ROA_{it-1} + \delta G_i * ROA_{it}-1 + \varepsilon_{it}$$

ROA is pretax return on assets for supplier *i* for the year *t*. x_{it} is a vector of control variables for firm x at time t. G_i is a vector of relational measures, in the case of this analysis, existence of a customer equity stake, and dependence on customers for sales. ROA_{it-1} is the performance measure lagged by one year. $G_i * ROA_{it-1}$ is the interaction between the lagged ROA and relational variable. Lincoln, Gerlach, and Ahmadjian (1996) use a two year lag in their analysis of performance of larger members of intermarket groups, arguing that it takes some time for such large firms to coordinate action. In supplier networks the process is likely to be much faster since automaker and supplier share considerable information, and the automaker can move quickly to reallocate returns through the regular price negotiation process. Note that the lagged ROA means that one year must be eliminated from the analysis; consequently, analyses are reported for the years 1981-1993.

A negative value of the coefficient for this interaction term is evidence of intervention by group members to rescue it from low profitability or to divert excess profits elsewhere. I refer to this result as "redistribution."

Interviews: In addition to the quantitative analysis, I conducted interviews with 7 automakers and suppliers. These were open-ended interviews, conducted in Japanese. Each interview was approximately 2 hours long. I assured respondents that neither their names nor the names of their companies would be disclosed. While Japanese managers have been particularly open to foreign and Japanese observers regarding their production system, they tend to be much more concerned about disclosing information on profitability and allocation of profitability and were much more forthcoming in interviews once confidentiality was assured.

RESULTS

A comparison of automaker and supplier performance

Table 1 compares average return on assets of the 11 automakers with return on assets of the 126 suppliers between 1980 and 1993. Whether suppliers are more or less profitable than automakers depends upon the automaker. Toyota is significantly more profitable than its suppliers, and has twice the ROA of the second most profitable automaker, Honda. Nissan, on the other hand, is not significantly more profitable than its suppliers, while Isuzu is significantly less profitable than its suppliers. Contrary to Hypothesis 1, as a class, automakers are not consistently more profitable than suppliers.

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Table 1 about here

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Table 2 compares standard deviations of ROA between 1981 and 1993 between automakers and suppliers. Column 1 presents the standard deviation of ROA for each automaker. Column 2 presents the mean of the standard deviations of ROA of all suppliers of that automaker. For example, the standard deviation of Nissan's ROA during this period was .028. The mean standard

deviation of its 69 suppliers was .020 (e.g. the sum of the standard deviation of ROA of each supplier divided by 69). The standard deviation of Nissan suppliers' ROA is significantly lower than that of Nissan, as is the standard deviation of ROA of most suppliers when compared to automakers. Counter to Hypothesis 2, the profitability of suppliers is less variable than the profitability of automakers.

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Table 2 about here

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Figures 2 through 4 show supplier and automaker ROA's in each year of the period. These results must be interpreted with caution as they are comparisons between the ROA of a single automaker and the mean ROA across suppliers. Nevertheless, the figures offer some interesting insights. Figure 2 compares Toyota's ROA with that of its suppliers. In the early 1980's, Toyota benefited hugely from voluntary export restraints. Toyota's suppliers, however, did not share in much of these windfall profits. During the worst of the *endaka* period in 1985-1987 when the near-doubling of the value of the yen cut into profits, Toyota buffered its suppliers, by taking a large hit in profits (though remaining extraordinarily profitable). Toyota's profits increased again during the heady years of the bubble economy in the late 1980's. When the economy slowed down in the early 1990's, Toyota and its suppliers suffered together.

Figure 3 compares profits of Nissan and its suppliers. Nissan, though never as profitable as Toyota, took excess profits in the early 1980's. On the other hand, Nissan's drastic decrease in profitability in the early 1990's to negative numbers was not shared by its suppliers. Supplier profits were off somewhat from the heights of the bubble years, but as of 1992 had not sunk to Nissan's depths. This is not due to these suppliers diversifying by selling to a highly profitable Toyota. Even those Nissan suppliers highly dependent upon Nissan, and thus unlikely to be

selling much to Toyota, maintained reasonable levels of profits (the taboo against Nissan's core suppliers supplying to Toyota is only just beginning to disappear). These results are consistent with Ries' (1993) finding that automakers retained most of the windfall returns during the years of voluntary export restraints—but adds the extra information that these same automakers shielded their suppliers during bad times.

Figure 4 shows profits of Honda and suppliers. Honda did outperform its suppliers during the endaka years in the mid-1980's—it appears to be suppliers that took the biggest hit in 1986 while Honda's profits were consistently high. It is interesting to note that Honda describes itself as distinct from other automakers in its relatively arms-length management of suppliers. Honda resisted organizing a formal association of its suppliers (*kyoryokukai*); and was the only automaker to do so. The results remind us of the considerable diversity in supplier management styles among Japanese automakers.

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Figures 2-4 about here

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Comparison of performance levels between suppliers

Regression analyses presented in Tables 4 and 5 enable us to compare performance levels between suppliers. Table 3 presents means, standard deviations, and zero-order correlations for variables used in the regression analyses. Table 4 presents GLS regression results for analyses in which shareholding and volume dependence were measured across all automakers. Table 5 offers a more detailed examination of practices of individual automakers, with shareholding and volume dependence measured for each automaker.

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Table 3 about here

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Hypothesis 3 predicted that suppliers dependent upon a single customer for purchase of a large percentage of their output would be less profitable than diversified suppliers. The coefficient for supplier dependence (HERFSU) as shown in Model 1 of Table 4 is negative but not significant, and is quite small in magnitude. High levels of volume dependence on an automaker do not lead to lower profits.

In the analyses presented in Table 5, volume dependence was entered individually for each automaker. These results suggest that there are cases in which being highly dependent upon an automaker improves a supplier's profitability. The more of its output a supplier sells to Honda or to Mazda, the more profitable it is. Suppliers that sell a large percentage of their output to Toyota, on the other hand, do not share in Toyota's wealth—although neither do they suffer from their high dependence.

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Table 4 about here

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Hypothesis 4 predicted that smaller suppliers would suffer from their unfavorable bargaining position and do worse. Returning to Model 1 of Table 4, we see that on the contrary, size is negatively (though not significantly) related to profitability. In Table 5, when measures of affiliation to each automaker are disaggregated, the negative effect of size becomes significant.

Suppliers whose shares are held by automakers (CUSTSHS) perform significantly worse than independent suppliers, as shown in Model 1 of Table 4 (although Table 5 shows that the more shares of a supplier held by Toyota, the better that supplier does). A resource dependence

argument could be made to explain this effect: the more shares of a supplier an automaker holds, the more control over the supplier it has, and the more it is able to demand lower prices. It is not clear, however, why an automaker would actively seek to decrease profits in a supplier in which it has an ownership stake.

Redistribution

The puzzle of the negative and significant effect of automaker shareholding on supplier profitability disappears in Model 2 of Table 4. This model adds ROA lagged by one year and an interaction term created by multiplying the percent of a supplier's shares held by automakers times the lagged ROA. As predicted in Hypothesis 5, the sign of the coefficient of this interaction term is negative although not significant. This effect can be interpreted as follows: The relationship between ROA_t and ROA_{t-1} when an automaker holds none of a supplier's shares is .825. When an automaker holds 100% of that supplier's shares, the relationship is decreased by .156, and thus, the relationship is only .669.

Interactions were then added separately for each automaker. ROA_{t-1} was multiplied by the percentage of supplier shares held by Toyota, Nissan, and so on. These analyses indicate that the interaction effect between shares held by Toyota and lagged ROA works in the opposite direction from the interaction effect for most of the other automakers (these results are not reported here but are available from the author). The more of a supplier's shares held by Toyota, the greater the relationship between ROA_{t-1} and ROA_t. The presence of suppliers whose shares are held by Toyota in the sample surpresses the size and significance of the interaction effect: when suppliers whose shares are held by Toyota are removed, the coefficient of the interaction term nearly doubles in size and becomes significant. These results of an analysis of the sample, omitting suppliers whose shares are held by Toyota are shown in Model 4 of Table 4.

A careful examination of Toyota suppliers suggests the reason for the anomaly. Suppliers whose shares are held by Toyota tend not to perform as badly as suppliers whose shares are held by other

automakers. This suggests that Toyota keeps very close track of its suppliers and assists them before their profits get too low. Furthermore, when the regression is estimated only for suppliers whose ROA_{t-1} are over 0.1, the interaction effect between lagged ROA and percentage of shares held by Toyota becomes negative and significant, consistent with the redistribution hypothesis. The relative shortage of poor performers and the existence of a redistribution effect among strong performers indicates that Toyota does not allow suppliers whose shares it holds do too badly—but when they do too well, it quickly intervenes to redistribute excess profits to other suppliers.

The redistribution effect, in which low-performing suppliers are assisted at the expense of high performers, is not apparent among suppliers that sell a high percentage of their output to a single automaker, and appears only among suppliers linked to automakers by equity. This suggests that equity ties are the more meaningful dimension upon which group boundaries are defined. Mere dependence upon an automaker for purchase of a large proportion of its output is not enough to situate a supplier in that automaker's network.

Even when suppliers whose shares are held by Toyota are omitted from the sample, the redistribution effect is relatively small, though significant. For example, a 20% shareholding stake by an automaker is associated by about a 6% decrease in the relationship between ROA_{t-1} and ROA_t. in the case of a supplier for whom 20% of its shares are held by an automaker (a common scenario). There are several explanations for this. First, the relatively low magnitude of the effect may reflect a more sensitive adjustment process—in which automakers are in constant touch with their suppliers and can make rapid adjustments in their performance which cannot be picked up completely in a one year lag. Second, the redistribution effect becomes much larger when suppliers whose lagged ROA is particularly small or particularly large are measured. For example, in cases in which lagged ROA is negative or very high, the relationship between lagged ROA and present ROA goes to almost zero for a supplier in which automakers have an equity stake of around 20% but remains strong for an independent supplier. Automakers may allow the performance of their suppliers to vary within a set range—but intervene when performance strays from that range.

Although the analyses presented in this paper feature return on assets, I examined other dependent variables as well. Results for return on equity were similar in direction and significance. I also examined a number of alternative measurements of return on assets in addition to the measure reported (*keijyo rieki*). These results suggest a pattern that sheds light onto mechanisms of redistribution. The redistribution effect is less apparent when profits are measured by operating income divided by assets, and goes away completely when profits are measured by return on sales (sales minus cost of sales divided by sales). This suggests that redistribution may occurring through mechanisms other than pricing, such as loans, dispatch of managers, trade credit, or diffusion of technology.

Some managers interviewed suggested that off the book schemes to adjust purchase prices may also be a factor. A high-ranked purchasing manager of a large automaker described a system through which his department based semi-annual price reductions upon a supplier's previous profitability, but left the original price on the books, making the supplier make up the difference in cash.

DISCUSSION

This paper offers evidence that economic returns are distributed between automaker and supplier and among suppliers themselves in a logic removed from power and bargaining. Returns are allocated on the basis of need, with the core automaker adjusting purchase prices, providing additional financial and managerial assistance, and convincing (or coercing) other, healthy suppliers to participate in rescues.

We see suppliers protected against the vagaries of the economy, their customers' poor performance, and even their own mismanagement in two ways. First, automaker buffer their suppliers. In particularly good times, automakers reap most of the returns and suppliers benefit very little. In return, automakers bear the brunt of the shock in bad times—buffering their suppliers from the effects of the strong yen, for example. Automakers also protect suppliers when the

automakers themselves are doing poorly, as can be seen at Nissan in the early 1990's. While Nissan's profits dove, calling into question its very survival, even suppliers quite dependent upon Nissan managed a reasonable rate of return.

Profits are also redistributed from high to low performing suppliers. Suppliers who performed poorly in the previous year tend to do better, while suppliers who performed extremely well in the previous year tend to do worse. This effect occurs among suppliers whose shares are held by their customers. It is along the lines of shareholding that boundaries of these groups are drawn. The redistribution effect is not apparent among suppliers which sell a large proportion of their output to a single automaker but do not have an equity relationship.

Power or cooperation? Results presented in this paper are consistent with research critical of the dual economy perspective. There is no evidence that suppliers, as a class, do worse than buyers and buffer their customers against economic adversity. Resource dependence theory was not supported in these analyses. There is no evidence that automakers or larger, more independent suppliers use their stronger position to bargain for a greater share of the returns. Rather, there is a collective, network, logic in which returns are distributed among members of the network according to need and in the interest of network integrity and preservation.

It is possible that effects of dependence are visible not between automakers and first-tier suppliers but rather between first tier and second tier suppliers, and a closer examination of the second tier is warranted. Reliance on profitability as a measure of performance may also mask evidence of dualism and dependence. Suppliers may maintain stable performance and reasonable margins because they are able to pay lower wages and fire employees at will. Further research on differences in levels and variability of wage and employment between automakers and suppliers is necessary.

An issue related to power not addressed in this paper is the degree to which redistribution of profits from strong suppliers to the weak is voluntary and the degree to which it is mandated by the

automaker. Do strong suppliers provide technology, management, and other forms of assistance to the weak on their own volition, or under pressure from automakers? Strong suppliers may have had little choice but to subsidize weak group members in the past when there were few other opportunities for them to develop other customer relationships. Today, as opportunities to supply other customers, foreign as well as Japanese, we may begin to observe signs of breakdown in this system (Ahmadjian & Lincoln, 1997). Dissatisfaction with this system among strong suppliers may explain tensions today among members of the Toyota group. Nippondenso, Toyota's largest and probably most powerful supplier has been actively diversifying its customers. Could the efforts of Nippondenso and other large suppliers to break free of their groups be related to the desire to break from this system of redistribution?

Is redistribution insurance? A number of economists have argued that buyer-supplier networks and other types of Japanese industrial groupings are insurance schemes (Nakatani, 1984). Risk-averse suppliers, the argument goes, trade off higher returns for lower variance in returns (Kawasaki and McMillan, 1987; Asanuma and Kikutani, 1992). At face value, the results reported in this paper are consistent with risk-sharing—certain suppliers seem to trade off higher returns for protection from downside risk. However, there are important inconsistencies. First, redistribution occurs among suppliers whose shares are held by automakers, and it is not apparent why such suppliers would be more risk-averse than others. Second, when the model is estimated separately for large and small suppliers, the redistribution effect is apparent in both groups. If it was merely a matter of risk aversion, we should expect the redistribution effect to be far stronger in the sample of the more risk averse, small suppliers.

Why redistribution? I interviewed a number of managers of automakers and suppliers to assess the validity of the statistical analyses and get a better sense of the mechanisms behind redistribution. Many managers interviewed were not surprised at the notion of redistribution. As one purchasing department chief put it: "We look at the profitability of our suppliers carefully. We don't want them to show a loss. We want our suppliers to have a similar level of profit."

Managers also made it clear that while there were economic benefits to redistribution, the obligation to bail out troubled suppliers, even at the expense of high performers, was supported on cultural, institutional, as well as transactional levels. Three themes came out of these interviews: 1) managers took redistribution for granted as a "Japanese way" of doing things, 2) they feared concrete sanctions if they did not help their suppliers, and 3) they believed that redistribution made economic sense when suppliers had made high levels of specific investments.

On the socio-cultural level, the language used by managers to talk about group affiliation and obligation suggests that redistribution reflects proper "Japanese ethics" (as one manager put it). As one manager explained:

> "In the US, relations between buyer and supplier are cold—buyers can cut off suppliers at any time. Japanese firms are more hesitant to do this. There may be an economic logic, but it is not the Japanese way of doing things."

While studies have demonstrated that purely cultural explanations of the emergence of Japanese economic institutions are often inaccurate (see, for example, Gordon, 1985), managers' insistence that assisting troubled suppliers is "the Japanese way of doing things" cannot be ignored. It does not matter whether the desire to assist troubled suppliers springs naturally from Japanese culture or, as is the case with other practices such as life-time employment, is a relatively late development legitimized by an ideology consciously shaped from selected pieces of Japanese culture (Cole, 1979). Whatever the roots of the obligation, managers believe that honoring an obligation to maintain stability and survival in members of their corporate "family" is proper Japanese behavior.

The notion of the firm as a collective actor is reinforced as well by coercive pressures. Firms that try to counter the "Japanese ethic" of saving troubled group members may face strong pressure to behave according to Japanese social norms. One of the pressures most often mentioned to me was adverse publicity. Japanese companies are particularly concerned about protecting their reputation—and, according to managers, business reporters are constantly on the lookout for

instances of large firms threatening the jobs of supplier employees and give such threats prominent coverage. Said one manager, "Even the Nikkei (Japan's most respected business daily) tends to view the company as evil and employees as good...A bad image in the press will adversely affect our brand image, and we try to avoid it."

Labor unions, though usually docile and relatively supportive of management, tend to become active when jobs are threatened—and if a customer cuts off a relationship with a supplier, supplier jobs are likely to be threatened. Labor union officials that I met described the pressure that they had brought to bear on a firm that had cut of a relationship with an affiliate. Sit-ins at headquarters and late-night phone calls to the company president were designed to annoy and to damage the company's reputation.

The role of the state in coercing firms to come to the assistance of group members is less clear—but not unthinkable. The Japanese government has historically used firms themselves as instruments of economic policy—choreographing restructurings, orderly exit from troubled industries, and entrance into new industries by "encouraging" firms to help members of their groups. The present supplier networks in the automotive industry are in part an outgrowth of the industrial policy of the 1950's, in which auto parts makers and automakers were encouraged to form groups to facilitate transfer of capital and technology from automakers to the relatively backwards suppliers (Odaka, 1988).

While managers spoke of obligations to suppliers in terms of Japanese culture and Japanese institutions, they were often quick to add that assisting troubled group members often made good business sense. Among members of buyer-supplier networks, physical assets, intangible know-how, and interpersonal ties are often so closely intertwined it is difficult and costly to break a trading relationship. One manager described the potential costs of supplier bankruptcy:

> "If an important supplier runs into problems we have little choice but to help build them back up. This is our biggest headache, but what else can we do? If a supplier goes

bankrupt, we will have lost an important partner and it will be difficult for us to go elsewhere."

There is also a sense that specific investments made by the supplier are as valuable to the automaker as the supplier—and consequently it is in the automaker's best interests to keep the supplier afloat. As another manager put it:

"...in Japan, if a supplier runs into financial trouble or management problems, then the customer will help it since the technical core—the technical level that has been cultivated over the years—remains, so there is value in saving the supplier."

Suppliers as well as automakers see it in their best interest to preserve the health of other group members. Assets are so closely intertwined and relationships so difficult to substitute that trouble to one supplier often means trouble for the entire group. A striking example of this was the devastating fire at the factory of Aishin Seiki, one of Toyota's top suppliers. In February, 1997, an Aishin factory which produced a critical brake part for Toyota burned down. With only a few hours of inventory on hand, Toyota had to shut down 20 auto plants for 5 days. Repercussions were felt across the Toyota group—and the efforts of other Toyota suppliers to produce replacements for the part reflected how indistinguishable individual and collective interests had become. The shutdown of the Aishin factory had a severe impact across all Toyota suppliers—and getting Aishin back on line was in the best interests of all (Reitman, 1997).

Redistribution as governance? A number of scholars have used a transaction cost framework to explain the successful purchasing practices in the Japanese automotive industry (Dyer, 1995; Nishiguchi, 1994). High levels of investment in customer-specific assets on the part of suppliers, they argue, are key factors behind the high levels of quality, flexibility, and cost competitiveness that have made the industry a formidable global competitor. While these scholars have documented empirically the high degree of customer-specific assets on the part of Japanese auto parts suppliers, just how these buyer supplier relationships are governed remains controversial. Japanese

automakers in general do not own their suppliers, and while equity stakes are common, they tend to be minority shares. Neither do Japanese automakers and suppliers sign specific, contingent contracts. Rather, the contracts serve as a framework for an ongoing relationship, with prices and quantities renegotiated at regular intervals (Asanuma, 1989).

Redistribution may explain, in part, the willingness of suppliers to make customer-specific investments without the protection of detailed contracts or ownership. An automaker is unlikely to behave opportunistically towards a supplier if it has an obligation to bail that supplier out of trouble. With this assurance of protection, a supplier is less worried about customer opportunism and more willing to make specific investments. The finding that redistribution occurs among suppliers whose shares are held by automakers further supports a transaction cost interpretation. Automakers tend to hold shares of those suppliers with high degrees of specific investments (Ahmadjian, 1997).

While redistribution can be explained as rational according to transaction cost economics, interviews with managers suggest that the decision to assist troubled suppliers at the expense of high perfomers is not based entirely upon rational calculation. Automakers bail out troubled suppliers because it is the way things are done in Japan and because they fear for their reputation. Economic interests are supported by cultural and institutional pressures.

Redistribution across the Japanese economy More support for the notion that redistribution is not merely a matter of rational calculation and economic self-interest comes from the finding that this process is not limited to buyers and suppliers in the automotive industry. Large firms linked to horizontal intermarket groups—members of the Mitsubishi, Mitsui, Sumitomo and other groups—also redistribute profits from strong to weak performers (Lincoln, Gerlach, and Ahmadjian, 1996). While members of these groups do have purchasing relationships (in particular, of industrial products, such as steel and chemicals), it is more difficult to argue that they have made substantial investments in group-specific assets as in the automotive industry. The existence of

redistribution in very different types of business groups in Japan supports the notion that redistribution is buttressed by a strong sense of "taken-for-grantedness" as well as by institutional pressures.

CONCLUSION

While markets and hierarchies have been defined in part by their systems profit allocation—in markets by bargaining and in hierarchies by fiat (Williamson, 1985)—there has been little research into the allocation of returns in networks. This paper demonstrated that within Japanese auto parts supply networks returns are allocated through a particularly network logic of distribution. Returns are redistributed between customer and supplier and among suppliers themselves. Close affiliation to an automaker, through an equity tie, means that a supplier will be protected from poor performance but will not be allowed to maintain inordinately high levels of profitability for long.

This system of incentives is economically rational—and consistent with transaction cost economics. Redistribution encourages a supplier to make automaker-specific investments with the assurance of continued survival and a reasonable rate of return. Yet this system of incentives is deeply embedded as well. Redistribution of profits from high to low performing group members works in auto parts supply networks just as it works across other types of groups in the Japanese economy. This underlying logic of redistribution is arguably as reasonable to a Japanese manager as individual profit maximization to an American.

The convergence between the institutional and the economic raises several questions that warrant further research. The first concerns the causal sequence of redistribution and specific asset investments. One possibility is that strong norms of redistribution were already in place when auto parts supply networks began to take shape. Obligations for customers to assist affiliated suppliers, for firms to assist members of their "family" were already acknowledged and supplier investments customer-specific assets took place in this context. Another possibility is that the notion of redistribution evolved along with the networks as a legitimating ideology.

The embeddedness of the redistribution effect also raises an important question as to the transferability of Japanese supplier management practices to other contexts. Although American automakers claim to be reorganizing their supplier relationships along more Japanese lines (Liker, Kamath, Wasti and Nagamachi, 1995) it is unlikely that the practice of redistribution has been adopted along with other elements of these relationships. Redistribution has not been necessary so far—the US auto industry has been doing well. What will become of these new supply relations in an economic downturn?

What happens in Japan when the rules of the game change and the norms of redistribution disappear? Already there is evidence from my interviews as well as accounts in the business press that assisting troubled group members is becoming less "the way things are done." Suppliers, it is claimed, must survive or fail based upon their own capabilities. It is yet to be seen in Japan if this talk is merely rhetoric, or reflects actual changes. Talk of suppliers "standing on their own two legs" may be rhetoric, consciously manipulated by automakers who hope to break away from long-standing relationships and take advantage of lower cost foreign and domestic suppliers. It may reflect more general societal trends away from collective group responsibility towards more individual profit maximization. Whatever the roots of the change in rhetoric about buyer-supplier relationships, it raises an important question for the future: if it is no longer taken for granted that buyers will protect their closest suppliers, will suppliers still be willing to make the substantial, and potentially hazardous, commitments to customers upon which these networks have been based?

REFERENCES

Ahmadjian, C. L. (1997). "Japanese supply networks and the governance of interfirm exchange." Unpublished working paper. Columbia University.

Ahmadjian, C. L., & Lincoln, J. R. (1996). "Changing firm boundaries in the Japanese auto parts industry." Conference paper presented at Make Versus Buy: The New Boundaries of the Firm. Columbia Law School, February 1997.

Aoki, M. (1988). Information, Incentives, and Bargaining in the Japanese Economy. Cambridge: Cambridge University Press.

Asanuma, B. (1989). "Manufacturer-supplier relationships in Japan and the concept of relation-specific skill." Journal of the Japanese and International Economies, 3: 1-30.

Asanuma, B., and Kikutani, T. (1992). "Risk absorption in Japanese subcontracting: A microeconometric study of the automobile industry." Journal of the Japanese and International Economies, 6: 1-29.

Ballon, R. J., and Tomita, I. (1988). The Financial Behavior of Japanese Corporations. Tokyo: Kodansha International.

Broadbridge, S. (1966). Industrial Dualism in Japan: A Problem of Economic Growth and Structural Change. London: Frank Cass and Co., Ltd.

Burt, R. S. (1983). Corporate Profits and Cooptation: Networks of Market Constraints and Directorate Ties in the American Economy. New York: Academic Press.

Caves, R. E., and Uekusa, M. (1976). Industrial Organization in Japan. Washington DC: Brookings Institution.

Clark, R. (1979). The Japanese Company. New Haven: Yale University Press.

Cole, R. E. (1979). Work, Mobility, and Participation: A Comparative Study of American and Japanese Industry. Berkeley: University of California Press.

Cusumano, M. A. (1989). The Japanese Automobile Industry: Technology and Management at Nissan and Toyota. Cambridge, MA: Harvard University Press.

DiMaggio, P., and Powell, W. W. (1983). "The iron cage revisited: Institutional isomorphism and collective rationality in organizational fields." American Sociological Review, 48: 147-160.

Dyer, J. H. (1995). "Specialized networks as a source of competitive advantage: Evidence from the auto industry." Strategic Management Journal, 17: 271-291.

Emerson, R. M. (1962). "Power-dependence relations." American Sociological Review, 27: 31-40.

Gerlach, M. L. (1991). "Twilight of the keiretsu? A critical assessment." Journal of Japanese Studies, 18: 79-118.

Granovetter, M. (1985). "Economic action and social structure: A theory of embeddedness." American Journal of Sociology, 91:481-510.

Gordon, A. (1985). The Evolution of Labor Relations in Japan. Cambridge, MA.: Harvard University Press.

Hamilton, G. G., & Biggart, N. W. (1988). "Market, culture, and authority: A comparative analysis of management and organization in the Far East." American Journal of Sociology, 94: S52-S94.

Harrison, B. (1994). Lean and Mean: The Changing Landscape of Corporate Power in the Age of Flexibility. New York: Basic Books.

Hodder, J. E., and Tschoegl, A. E. (1985). "Some aspects of Japanese corporate finance." Journal of Financial and Quantitative Analysis, 20: 173-191.

Hoshi, T., Kashyap, A., and Scharfstein, D. (1990). "The role of banks in reducing the costs of financial distress in Japan." Journal of Financial Economics, 27: .

IRC. 1987. Jidosha Buhin no 160 Hinmei no Seisan Ryutsu Chosa [A Survey of Manufacture and Distribution of 160 Auto Parts]. Nagoya: IRC.

Kawasaki, S., and McMillan, J. (1987). "The design of contracts: Evidence from Japanese subcontracting." Journal of the Japanese and International Economies, 1: 327-349.

Liker, J. K., Kamath, R. R., Wasti, S. N., and Nagamachi, M. (1995). "Integrating suppliers into fast-cycle product development." In J. K. Liker, J. E. Ettlie, and J. C. Campbell (Eds.), Engineered in Japan: Japanese Technology-management Practices. New York: Oxford University Press.

Lincoln, J. R., Gerlach, M. L., and Ahmadjian, C. L. (1996). "Interfirm networks and corporate performance in Japan." American Sociological Review, 61: 67-88.

Nakatani, I. (1984). "The economic role of financial corporate grouping." In M. Aoki (Ed.), The Economic Analysis of the Japanese Firm. Amsterdam: North Holland.

Nihon Keizai Shimbun [Japan Economic Journal] 1989. Kaisha Nenkan [Company Annual, Listed Firms]. Tokyo: Nihon Keizai Shimbun-sha.

Nihon Keizai Shimbun [Japan Economic Journal] 1993. "Wadai no kaisha: Toyota Koki" [Company in the News: Toyota Machine Works] 11/1/93:41.

Nishiguchi, T. (1994). Strategic Industrial Sourcing: the Japanese Advantage. New York: Oxford University Press.

Odaka, K., Ono, K., and Adachi, F. (1988). The Automobile Industry in Japan: A Study of Ancillary Firm Development. Tokyo: Kinokuniya Company Ltd.

Orru, M., Biggart, N. W., & Hamilton, G. G. (1991). "Organizational isomorphism in East Asia" In W. W. Powell & P. J. DiMaggio (eds.), The New Institutionalism in Organizational Analysis. Chicago: University of Chicago Press.

Oliver, C. (1990). "Determinants of interorganizational relationships: Integration and future directions." Academy of Management Review, 15: 241-265.

Pfeffer, J., and Salancik, G. R. (1978). The External Control of Organizations: A Resource Dependence Perspective. New York: Harper and Row.

Piore, M. J., and Sabel, C. F. (1984). The Second Industrial Divide: Possibilities for Prosperity. New York: Basic Books.

Powell, W. W. (1990). "Neither market nor hierarchy: Network forms of organization." Research in Organizational Behavior, 12: 295-336.

Reitman, V. (1997) "Toyota's fast rebound after fire at supplier shows why it is tough." Wall Street Journal. 5/8/97 page 1.

Ries, J. C. (1993). "Windfall profits and vertical relationships: who gained in the Japanese auto industry from VERs?" The Journal of Industrial Economics, 16: 259-276.

Sakai, K. (1990). "The feudal world of Japanese manufacturing." Harvard Business Review, November-December: 38-48.

Saxenian, A. (1994). Regional Advantage: Culture and Competition in Silicon Valley and Route 128. Cambridge, MA: Harvard University Press.

Smitka, M. J. (1991). Competitive Ties: Subcontracting in the Japanese Automotive Industry. New York: Columbia University Press.

Uzzi, B. (1996). "Embeddedness and economic performance: The network effect." American Sociological Review, 61:674-698.

van Wolferen, K. (1989). The Enigma of Japanese Power. London: Macmillan.

Watanabe, Y. (1985). "Shitauke, keiretsu chusho kigyo" [Subcontractors, keiretsu small and medium-sized companies]. In K. Takizawa (Ed.), Nihon no Chusho Kigyo Kenkyu [Japanese Small and Medium-sized Enterprises] (Vol. 1,). Tokyo: Yuhikaku.

Williamson, O. E. (1985). The Economic Institutions of Capitalism. New York: The Free Press.

Womack, J. P., Jones, D. T., and Roos, D. (1990). The Machine that Changed the World. New York: Macmillan.

Table 1: Mean of ROA, by Automaker and Supplier Type, 1981-1993

Automaker	Mean ROA of automaker	Mean ROA of all suppliers of automaker	Suppliers in which automaker has equity stake	Suppliers that sell 50% or more of output to automaker
Toyota	.112	.052* (.028) n=69	.052* (.027) n=37	.059* (.027) n=17
Nissan	.048	.046 (.025) n=69	.043 (.024) n=32	.043* (.020) n=21
Isuzu	.003	.043* (.027) n=62	.027* (.024) n=12	.010 (.016) n=8
Honda	.058	.053 (.028) n=55	.052 (.021) n=12	.060 (.026) n=9
Mazda	.039	.050 (.026) n=67	.063 (.024) n=4	.042 n=1
Nissan Diesel	.007	.044* (.026) n=65	.022 n=1	.035* (.006) n=3
Fuji	.028	.050* (.025) n=56	.017 (.014) n=2	.046 (.055) n=2
Suzuki	.043	.050 (.026) n=65	.02 n=1	.037 n=1
Mitsubishi	.024	.048* (.030) n=72	.036 (.017) n=8	.024 (.030) n=6
Daihatsu	.025	.051* (.024) n=54	.045 (.015) n=3	.042 (.008) n=2
Hino	.037	.042 (.027) n=49	.036 (.019) n=5	.008 (.001) n=2

* significantly different from automaker ROA at .01 level

Table 2: Mean of standard deviation in ROA by Automaker and Supplier, 1981-1993

Automaker	Standard deviation of ROA of automaker 1981-1993	All suppliers of automaker	Suppliers in which automaker has equity stake	Suppliers that sell 50% or more of output to automaker
Toyota	.043	.022* (.011) n=69	.021* (.009) n=37	.027* (.011) n=17
Nissan	.028	.020* (.010) n=69	.021 (.009) n=32	.021 (.010) n=21
Isuzu	.025	. 021* (.009) n=62	.024 (.012) n=12	.019 (.009) n=8
Honda	.017	.022* (.010) n=55	.021 (.008) n=12	.028 (.011) n=9
Mazda	.033	.022* (.010) n=67	.034 (.014) n=4	.007 n=1
Nissan Diesel	.013	.021* (.010) n=65	.009 n=1	.027* (.023) n=3
Fuji	.053	.022* (.010) n=56	.016* (.003) n=2	.023 (.013) n=2
Suzuki	.012	.021* (.009) n=65	.018 n=1	.017 n=1
Mitsubishi	.010	.023* (.012) n=72	.019 (.008) n=8	.027 (.019) n=6
Daihatsu	.014	.022* (.011) n=54	.032 (.018) n=3	.038 (.018) n=2
Hino	.013	.021 (.009) n=49	.032 (.010) n=5	.034* (.003) n=2

* significantly different from automaker ROA variance at .01 level

Table 3: Means, Standard Deviations, and Zero-Order Correlations: 126 Auto Parts Suppliers, 1981-1993

	variable	mean	s.d.	1	2	3	4	5	6
1	year of founding	37.99	14.42	1	-.03	-.22	.26	.10	.09
2	debt/ equity	3.01	4.25		1	.02	-.08	.09	-.39
3	ln total assets	11.38	1.47			1	-.26	.05	-.09
4	% shares held by customers (CUSTSHS)	.10	.14				1	.06	-.02
5	concentration of sales (HERFSU)	.65	.65					1	-.06
6	return on assets	.04	.04						1

Table 4. GLS Regressions of Return-on-Assets (ROA) on Measures of Network Affiliation and Control Variables, 126 Auto Parts Suppliers 1981-1993.

Model	1	2	3	4 (see note)	5 (see note)
Intercept	0.270*** (0.027)	0.063*** (0.019)	0.063** (0.019)	.062** (.025)	.065** (.025)
Fiscal Year	-0.002*** (0.0003)	-0.0006** (0.0002)	-0.0006** (0.0002)	-.0006** (.0003)	-.0006* (.0003)
Debt/Equity Ratio	-0.004*** (0.0002)	-0.0003** (0.0001)	-0.0003** (0.0001)	-.0002 (.0001)	-.0002 (.0001)
ln assets	-0.0007 (0.0006)	-0.00008 (0.0003)	-0.0001 (0.0003)	.00004 (.0004)	-.0001 (.0004)
Year of Founding	0.0003*** (0.00006)	0.000008 (0.00003)	0.00001 (0.00003)	.00002 (.00004)	.00003 (.00004)
% of shares held by customers (CUSTSHS)	-0.026*** (0.006)	0.0008 (0.005)	-0.006 (0.004)	.003 (.006)	-.008 (.004)
Concentration of Sales (HERFSU)	-0.004 (0.003)	-0.001 (0.001)	-0.002 (0.002)	-.001 (.002)	-.004 (.003)
ROA_{t-1}		0.825*** (0.016)	0.798*** (0.031)	0.814*** (.018)	.732*** (.042)
ROA_{t-1} *% of shares held by customers		-0.156 (0.085)		-.275** (.102)	
ROA_{t-1} * concentration of sales			0.017 (0.040)		.081 (.050)
N	1638	1638	1638	1157	1157
R2	.21	.76	.76	.81	.81

*p<.05; **p<.01; ***p<.001 (two-tailed test)

note: Models 4 and 5 exclude all suppliers whose shares are held by Toyota.

Table 5. GLS Regressions of Return-on-Assets (ROA) on Measures of Network Affiliation and Control Variables, 126 Auto Parts Suppliers 1981-1993, By Automaker

Model	1
Intercept	0.257*** (0.026)
Fiscal Year	-0.002*** (0.0003)
Debt/Equity Ratio	-0.003*** (0.0002)
In Assets	-0.001* (0.0006)
Year of Founding	0.0003*** (0.00006)
% of shares held by Toyota	0.037** (0.012)
% of shares held by Nissan	-0.023* (0.011)
% of shares held by Honda	-0.063** (0.019)
% of shares held by Mazda	0.080 (0.118)
% of shares held by Mitsubishi Motors	-0.092 (0.067)
% of shares held by Isuzu	-0.070*** (0.020)
% reliance on Toyota	0.006 (0.004)
% reliance on Nissan	0.002 (0.004)
% reliance on Honda	0.024*** (0.005)
% reliance on Mazda	0.035*** (0.007)
% reliance on Mits.	-0.007 (0.005)

% reliance on Isuzu	-0.017*** (0.005)
N	1638
R2	.31

*p<.05; **p<.01; ***p<.001 (two-tailed test)

Figure 1: Redistribution Effect

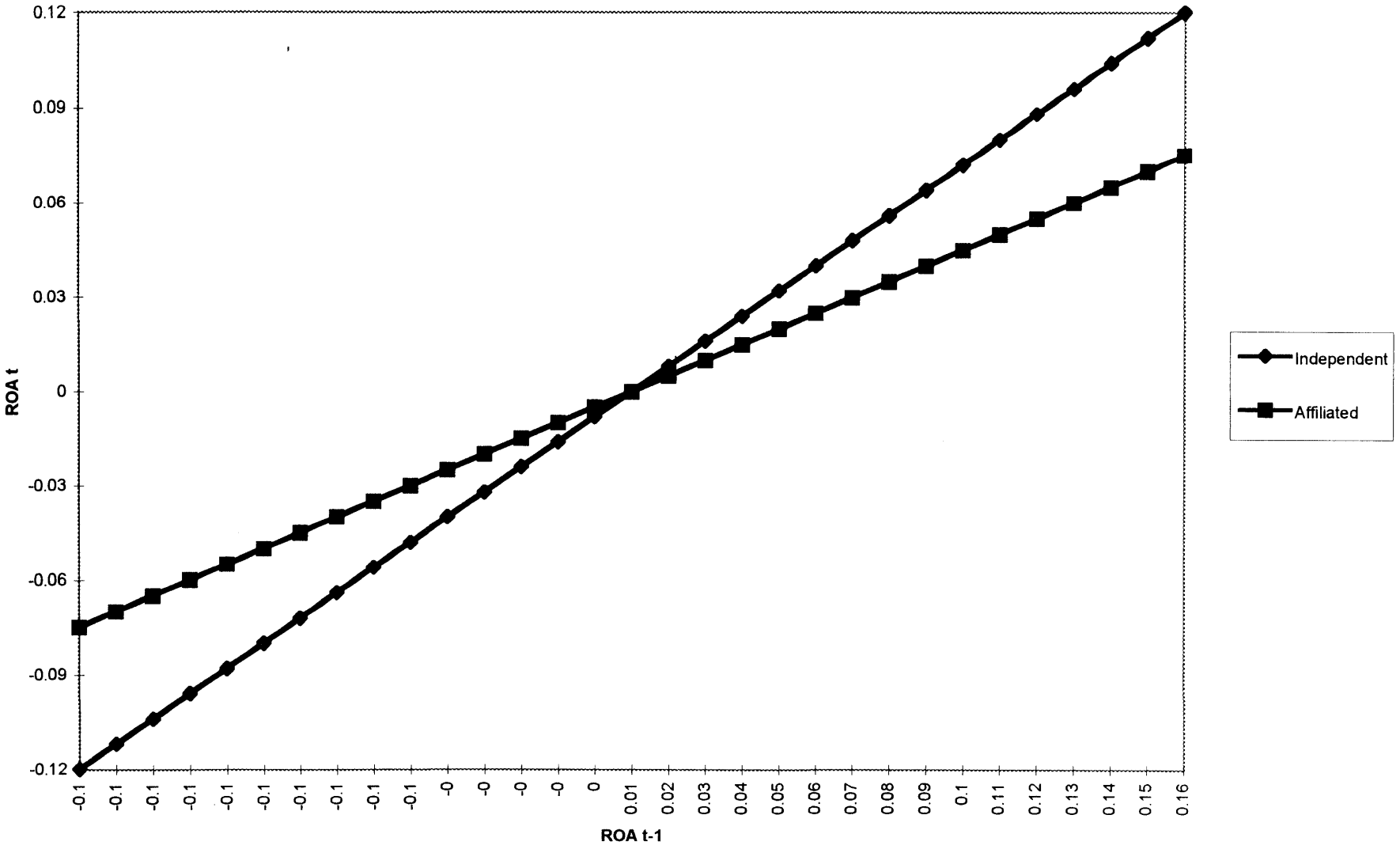


Figure 2

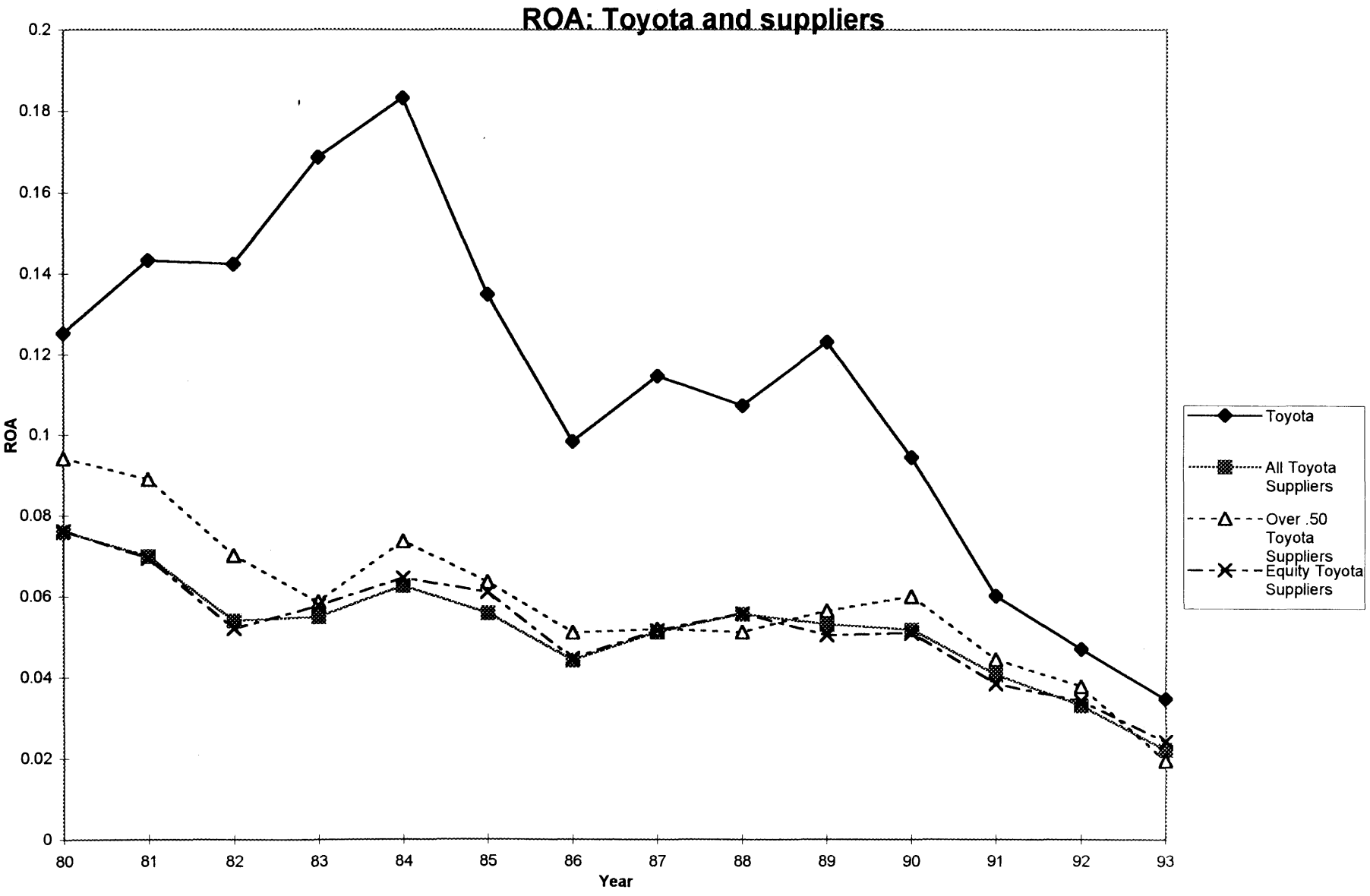

ROA: Toyota and suppliers
ROA
0.2
0.18
0.16
0.14
0.12
0.1
0.08
0.06
0.04
0.02
0
80
81
82
83
84
85
86
87
88
89
90
91
92
93
Year
Toyota
All Toyota Suppliers
Over .50 Toyota Suppliers
Equity Toyota Suppliers

Figure 3

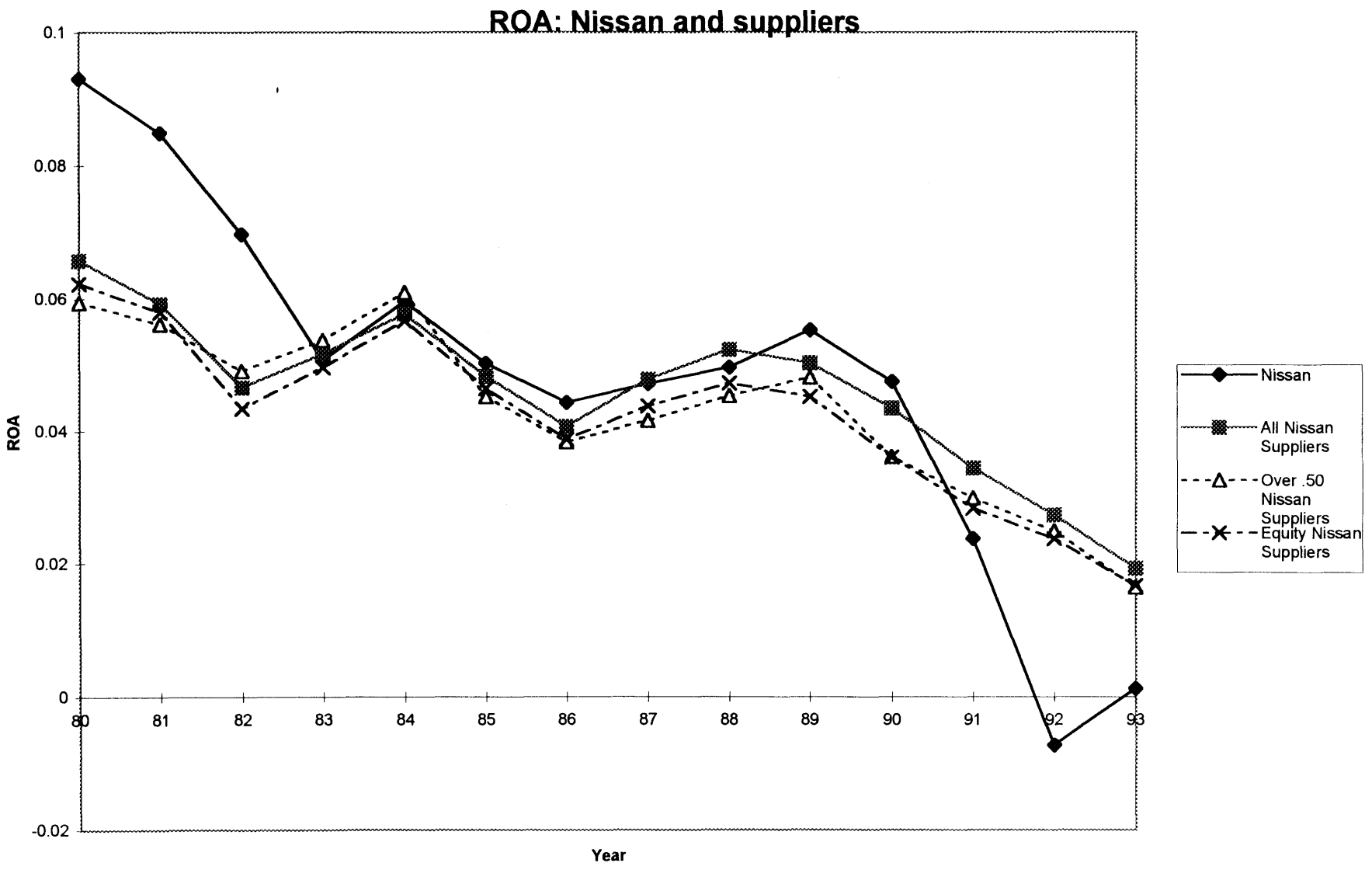
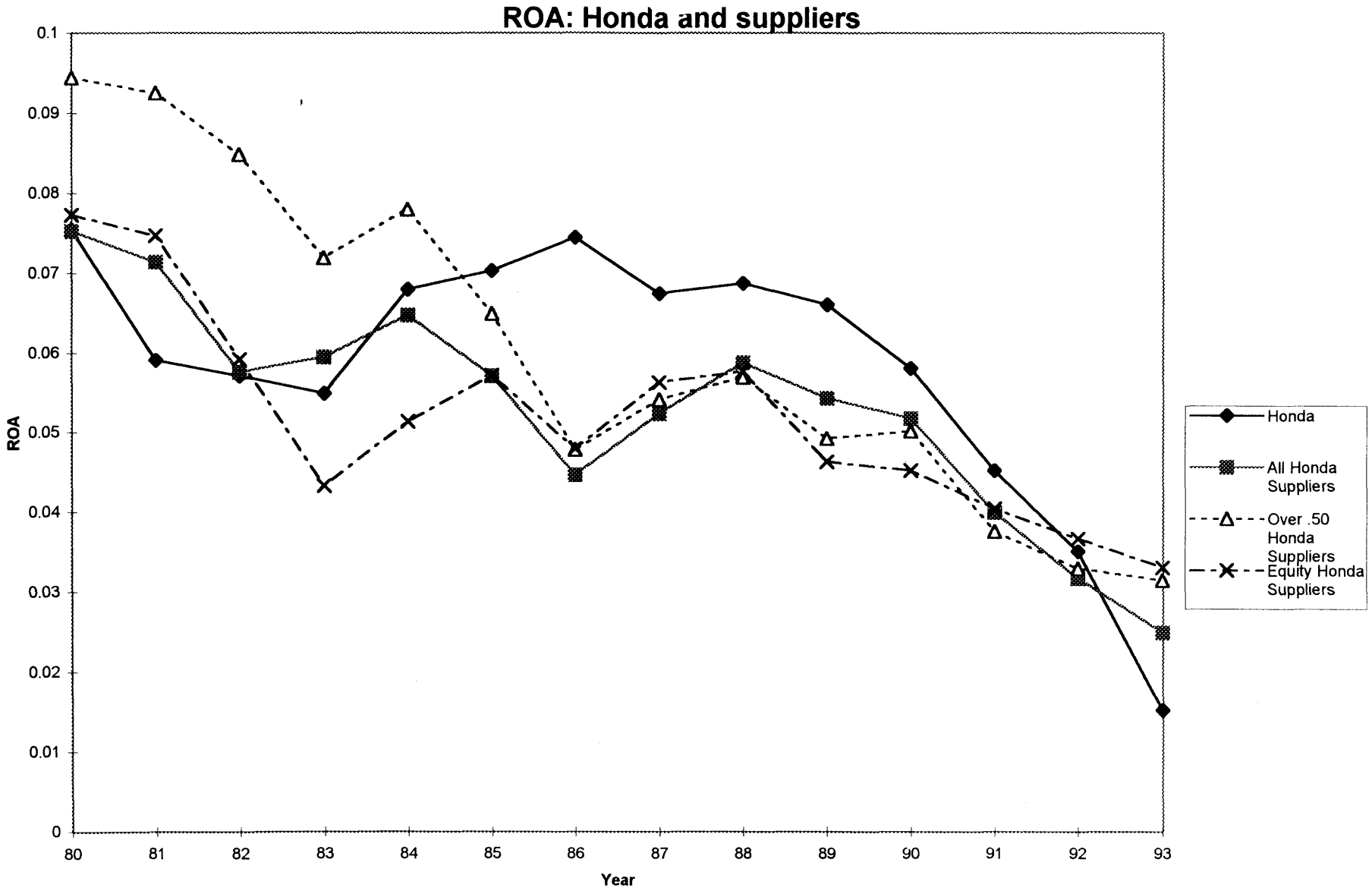

ROA: Nissan and suppliers
0.1
0.08
0.06
0.04
0.02
0
-0.02
ROA
80
81
82
83
84
85
86
87
88
89
90
91
92
93
Year
Nissan
All Nissan Suppliers
Over .50 Nissan Suppliers
Equity Nissan Suppliers

Figure 4


ROA: Honda and suppliers
0.1
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
ROA
80
81
82
83
84
85
86
87
88
89
90
91
92
93
Year
Honda
All Honda Suppliers
Over .50 Honda Suppliers
Equity Honda Suppliers